
*Proposed Resource Management Plan and
Final Environmental Impact Statement*

Bighorn Basin Resource Management Plan Revision Project

Appendix J

Air Resources Management Plan

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APPENDIX J

AIR RESOURCES MANAGEMENT PLAN

1.0 INTRODUCTION

1.1 Background

- 1.1.1 Preparation of the Analysis of the Management Situation in 2008 disclosed monitoring data within and adjacent to the Planning Area is limited. Concern arose over the need to establish background concentrations and to have monitoring in place prior to increased development.
- 1.1.2 The need for establishing background concentrations was not based on concern over existing air quality, but rather to provide adequate monitoring to characterize changes over time. Table J-1 is an overview of the applicable primary WAAQS and NAAQS and baseline representative maximum pollutant concentrations measured in and at sites near the Planning Area. These representative concentrations can be compared with the applicable WAAQS and NAAQS to indicate the status of recent air quality conditions within the Planning Area relative to the standards.
- The examination of these data indicates that the current air quality for criteria pollutants in the Planning Area is considered good overall. Based upon measurements taken at the North Absaroka IMPROVE site (Figure J-1) and the Cloud Peak IMPROVE site (Figure J-2), visibility in the Planning Area is considered excellent.
- 1.1.3 To address the monitoring data limitation at the land use planning level, the BLM and cooperating agencies developed Management Action 1002 to establish a monitoring network to provide additional data for describing background concentrations.
- 1.1.4 The BLM established a monitoring site approximately 25 miles north of Worland in Big Horn County, known as the Basin site. The purpose of this station is to provide a general indicator of existing air quality and long term trends in air quality but is not intended for NAAQS compliance.
- 1.1.5 The emissions projected in the emissions calculations in Appendix U of the **Proposed Resource Management Plan (RMP)** and **Final Environmental Impact Statement (EIS)** have potential to negatively impact visibility and air quality in Bridger, Fitzpatrick, North Absaroka, and Washakie Wilderness Areas and Yellowstone National Park depending upon the temporal and spatial distribution of development. This emission inventory was compiled for the Planning Area to determine the relative magnitude of total air pollutant emissions to compare emissions and associated impacts between the alternatives. The estimated levels of emissions for each alternative are summarized in Table J-2. Projected emissions are similar to those of the base year, 2008, as shown in Table J-2 and Table J-3. The emission inventory also revealed that emissions would primarily result from mineral development and production.

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Table J-1. Applicable National and State Primary Air Quality Standards for Criteria Pollutants and Baseline Representative Concentrations for the Planning Area

Pollutant	Averaging Time	NAAQS			WAAQS			Representative Concentrations		
		(ppm)	(ppb)	($\mu\text{g}/\text{m}^3$)	(ppm)	(ppb)	($\mu\text{g}/\text{m}^3$)	(ppm)	(ppb)	($\mu\text{g}/\text{m}^3$)
Carbon Monoxide	1 hour ¹	35	35,000	40,000	35	35,000	40,000	1.7	1,730	1,979
	8 hour ¹	9	9,000	10,000	9	9,000	10,000	0.8	814	931
Nitrogen Dioxide	1 hour ²	0.10	100	189	0.10	100	189	0.014	14	26.4
	Annual ³ (Arithmetic Mean)	0.053	53	100	0.053	53	100	0.00168	1.68	2.9
Ozone	8 hour ⁴	0.075	75	147	0.075	75	147	0.062	62	121
PM ₁₀	24 hour ⁵	N/A	N/A	150	N/A	N/A	150	N/A	N/A	78
	Annual ⁶	N/A	N/A	N/A	N/A	N/A	50	N/A	N/A	11
PM _{2.5}	24 hour ⁷	N/A	N/A	35	N/A	N/A	35	N/A	N/A	5.0
	Annual ⁸	N/A	N/A	12	N/A	N/A	15	N/A	N/A	1.8
Sulfur Dioxide ¹⁰	1 hour ⁹	0.075	75	197	0.075	75	197	0.033	33	86

¹Not to be exceeded more than once per year. Data collected at Yellowstone National Park during 2005.

²To attain this standard, the 3-year average of the 98th percentile of 1-hour concentrations at each monitor within an area must not exceed 100 ppb. Thunder Basin data, 2009.

³Thunder Basin annual average for 2009.

⁴To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 75 ppb. Measured fourth highest concentration for 2009 for the Thunder Basin site.

⁵Not to be exceeded more than once per year on average over 3 years. Maximum 24-hour average for 2009 at Cody SLAMS site.

⁶Annual average for 2009 for Cody SLAMS site.

⁷To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor in an area must not exceed 35 $\mu\text{g}/\text{m}^3$. Maximum 24-hour average for 2009 for the North Absaroka IMPROVE site.

⁸To attain this standard, the 3-year average of the weighted annual mean PM_{2.5} concentrations from single or multiple community-oriented monitors must not exceed 12.0 $\mu\text{g}/\text{m}^3$. Annual average for 2009 for the North Absaroka site.

⁹To attain this standard, the 3-year average of the 98th percentile of 1-hour concentrations at each monitor within an area must not exceed 75 ppb.

¹⁰The SO₂ value is from the Wyoming DEQ Casper monitor, located in Natrona County and is the 3-year average of the 98th percentile of 1-hour concentrations measured for 2011, 2012, and 2013. Although not located in the Bighorn Basin, this is the closest monitor with available recent data.

$\mu\text{g}/\text{m}^3$ micrograms per cubic meter

N/A Not Applicable

NAAQS National Ambient Air Quality Standards

PM_{2.5} particulate matter less than 2.5 microns in diameter

PM₁₀ particulate matter less than 10 microns in diameter

ppb parts per billion

ppm parts per million

SLAMS State and Local Air Monitoring Site

WAAQS Wyoming Ambient Air Quality Standards

Figure J-1. Visibility – Standard Visual Range (SVR, miles) for the North Absaroka, Wyoming, IMPROVE Site

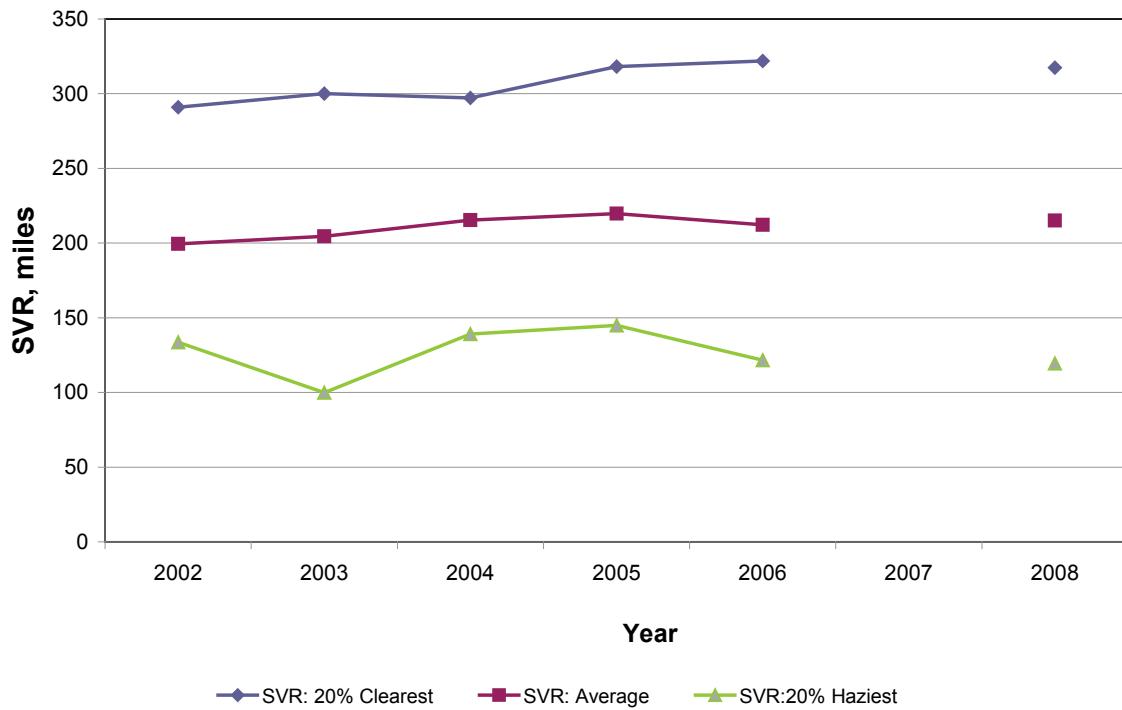
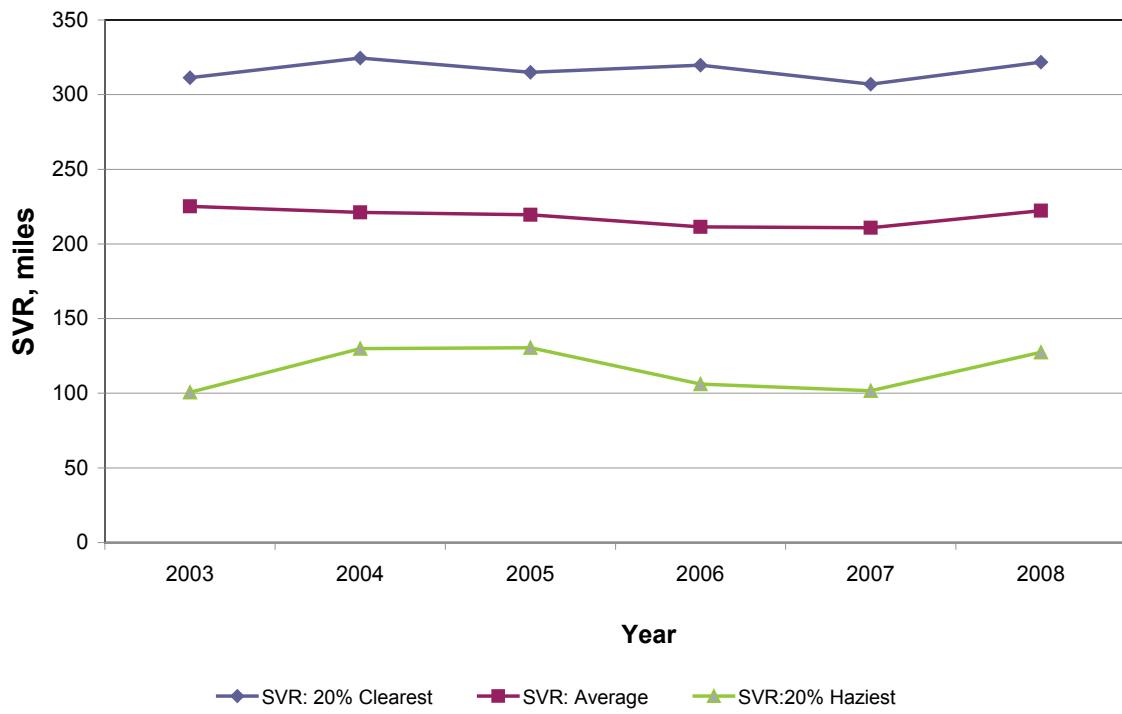


Figure J-2. Visibility – Standard Visual Range (SVR, miles) for the Cloud Peak, Wyoming, IMPROVE Site



Appendix J – Air Resources Management Plan

Table J-2. Total Annual Emissions Summary for BLM Activities within the Bighorn Basin Planning Area

Summary Year	Emissions (tons per year)						
	PM ₁₀	PM _{2.5}	NO _x	SO ₂	CO	VOC	HAP
Base Year (2008) Total	3,860	673	724	28	4,303	1,837	98
Alternative A							
2018 Total	4,137	707	746	30	4,470	1,683	97
2027 Total	3,995	682	755	30	4,243	1,405	97
Alternative B							
2018 Total	3,716	587	536	19	3,510	1,560	82
2027 Total	3,571	563	543	20	3,303	1,265	80
Alternative C							
2018 Total	4,742	910	831	44	6,293	1,802	110
2027 Total	4,598	886	839	45	6,079	1,536	111
Alternative D Preferred Alternative							
2018 Total	4,056	697	709	29	4,458	1,627	89
2027 Total	3,973	679	744	30	4,234	1,390	95
Alternative E							
2018 Total	3,553	536	558	19	3,429	1,606	89
2027 Total	3,393	511	540	19	3,213	1,260	79
Alternative F							
2018 Total	4,069	700	735	30	4,466	1,677	96
2027 Total	3,909	671	684	29	4,206	1,189	69

BLM	Bureau of Land Management	PM _{2.5}	particulate matter less than 2.5 microns in diameter
CO	carbon monoxide	PM ₁₀	particulate matter less than 10 microns in diameter
HAP	hazardous air pollutant	SO _x	sulfur oxides
NO _x	nitrogen oxides	VOC	volatile organic compound

Table J-3. Percent Change in Emissions Compared to Base Year 2008

Summary Year	Percent Change in Emissions (tons per year)						
	PM ₁₀	PM _{2.5}	NO _x	SO ₂	CO	VOC	HAP
Alternative A							
2018 Total	7%	5%	3%	6%	4%	-8%	7%
Alternative B							
2018 Total	-4%	-13%	-26%	-32%	-18%	-15%	-16%
Alternative C							
2018 Total	23%	35%	15%	58%	46%	-2%	13%
Alternative D (Preferred Alternative)							
2018 Total	5%	4%	-2%	4%	4%	-11%	5%
Alternative E							
2018 Total	-8%	-20%	-23%	-33%	-20%	-13%	-8%
Alternative F							
2018 Total	5%	4%	2%	5%	4%	-9%	-1%

CO carbon monoxide
 HAP hazardous air pollutant
 NO_x nitrogen oxides
 PM_{2.5} particulate matter less than 2.5 microns in diameter

PM₁₀ particulate matter less than 10 microns in diameter
 SO_x sulfur oxides
 VOC volatile organic compound

- 1.1.6 In June 2011, Memorandum of Understanding among the U.S. Department of Agriculture, U.S. Department of Interior and U.S. Environmental Protection Agency Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions Through the National Environmental Policy Act Process (MOU) was signed. This MOU outlines how to protect air quality and air quality related values, such as visibility and Class I areas, while allowing for oil and gas development on federally managed lands.
- 1.1.7 The Environmental Protection Agency's (EPA) comments on the Draft Resource Management Plan (RMP) and Draft Environmental Impact Statement (EIS), included “the EPA believes that the ‘level of concern’ that would warrant modeling under Management Action 1005 (contained in the Draft RMP) has already been reached.” This concern is based on the level of emissions from existing activity disclosed in the Draft EIS and the proximity of proposed leasing areas to five Federal Class I areas, including Bridger, Fitzpatrick, North Absaroka, and Washakie Wilderness Areas and Yellowstone National Park.
- Emissions from future activities have potential to negatively impact visibility and air quality in the Class I areas depending upon the temporal and spatial distribution of development.

1.2 Purpose

- 1.2.1 The purpose of this Air Resources Management Plan (ARMP) is to further clarify Physical Resources – Air Quality goals, objectives, and management actions set forth in Table 2-9 of the Final EIS. This ARMP describes air resources management; authorization of activities that have the potential to adversely impact air resources within the Planning Area; acknowledges areas where data is incomplete or difficult to obtain; sets a plan to obtain additional information; and outlines specific informational requirements and mitigation measures that may apply to projects that have the potential to generate air emissions and adversely affect air resources in the Planning Area.
- 1.2.2 This ARMP may be modified as necessary to comply with law, regulation, and policy and to address new information and changing circumstances. Amendment of the RMP is necessary to change the goals, objectives or management actions set forth in Table 2-9 while change to implementation, including this ARMP, may be made without Amending the RMP.

1.3 Characterization of Air Resources in the Environmental Impact Statement

1.3.1 Emissions Inventory for Land Use Planning

- 1.3.1.1 An air emissions inventory was compiled for the Planning Area to determine the relative magnitude of total air pollutant emissions and to compare emissions between alternatives. This emissions inventory is summarized in Appendix U. Emissions were calculated using assumptions about the likelihood of potential future activities occurring under each alternative which are found in Appendix T. As a result, the compiled air emissions inventory represents a comparison of emissions of air pollutants based on best available but speculative information for future development projections.
- 1.3.1.2 The emissions inventory is valuable for contrasting the impact of land use allocations on air resources among alternatives and useful for identifying those activities that are likely to be major contributors of emissions.
- 1.3.1.3 The air emissions inventory supports two major conclusions: 1) there is not a substantial difference in total air emissions among alternatives (Table 4-2), and 2) oil and gas development activities and mining are major contributors to air emissions.

1.3.2 Class I Areas

- 1.3.2.1 Class I areas in or near the Planning Area are Yellowstone National Park, North Absaroka Wilderness Area, Washakie Wilderness Area, Fitzpatrick Wilderness Area, and Bridger Wilderness Area. Visibility estimates for the North Absaroka site (Western boundary of the Planning Area) and the Cloud Peak site (eastern boundary of the planning area) are shown in Figures 3-12 and 3-13 of the Final EIS, respectively. The data from these two monitoring locations indicate excellent visibility.

2.0 AIR RESOURCES MANAGEMENT PLAN

2.1 Resource Inventory and Characterization

- 2.1.1 A characterization of air quality conditions in Class I areas in the vicinity of the planning area will be conducted to measure progress towards meeting the Air Quality goals and objectives (Table 2-9). BLM will conduct this characterization in partnership with federal and state agencies with responsibility for managing air quality in Class I areas, including DEQ, EPA, Forest Service and NPS, as soon as possible subject to funding and staffing levels.
- 2.1.1.1 This Class I area characterization will consist of two separate parts. Part I will be compilation of existing air quality data on the Class I area as provided and analyzed by partnering agencies. Part II will consist of a regional modeling analysis to characterize air quality in the Class I areas listed in Section 1.1.5. This modeling would be conducted either 1) as part of a specific development project air impact analysis being conducted by BLM for a NEPA analysis or 2) as part of an interagency regional modeling analysis that includes the Planning Area. With this modeling, the BLM could effectively predict direct Big Horn Basin emissions impacts to nearby Class I areas. Information from other modeling efforts and monitoring data will also be used to inform the Class I characterization. Details of this modeling are presented in Section 2.4 *Modeling*.
- 2.1.1.2 Until such time as both parts of the Class I characterization are completed Applications for Permit to Drill (APDs), field development proposals, and mining plans of operation, will include an emissions inventory. The emissions inventory will quantify emissions of regulated air pollutants from all sources related to the proposed project, emissions impacting Class I areas, including fugitive emissions and greenhouse gas emissions, estimated for each year for the life of the project. Additional information on permitting and emission inventories is provided in Section 2.2 *Permitting* and Section 2.5 *Mitigation*.
- 2.1.1.3 Based upon the findings of the Class I characterization, and as provided for by law and consistent with lease rights and obligations, BLM will ensure implementation of reasonable mitigation, control measures and design features through appropriate mechanisms, which may include lease stipulations and conditions of approval, notices to lessees, and permit terms and conditions (see Section 2.2 *Permitting* and 2.5 *Mitigation*)

2.2 Permitting

- 2.2.1 The BLM has the authority and responsibility under the Federal Land Policy and Management Act to manage public lands in a manner that will protect the quality of air and atmospheric values. Therefore, BLM may manage the pace, place, density, and intensity of leasing and development to meet air quality goals.
- 2.2.2 The BLM will, prior to authorization, consider the magnitude of potential air emissions from the project or activity, existing air quality conditions, proximity to Class I areas, and issues identified during project scoping to identify pollutants of concern and to determine the appropriate level of air analysis to be conducted for the project.
- 2.2.3 The BLM will require an emissions inventory, as set forth in the MOU. The MOU states “As early as possible in its planning process, the Lead Agency will identify the reasonably

foreseeable number of oil or gas wells that can be expressed as a range, expected to be located within the planning area. Existing reasonably foreseeable development scenarios can be used to identify the number of wells.” The BLM may require an emissions inventory for mineral development projects (such as mining operations and individual applications for permit to drill) and may require project specific air quality modeling (see Management Action 1006) depending on project characteristics, proximity to a federally mandated Class I area, sensitive Class II area, or population center, location within a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during project scoping. The emissions inventory will quantify emissions of regulated air pollutants from all sources related to the proposed project, emissions impacting Class I areas, including fugitive emissions and greenhouse gas emissions, estimated for each year for the life of the project. BLM will use this estimated emissions inventory to identify pollutants of concern and to determine the appropriate level of air analysis to be conducted for the proposed project. This information will inform monitoring (see Section 2.3 *Monitoring*), modeling (see Section 2.4 *Modeling*) and mitigation (see Section 2.5 *Mitigation*).

- 2.2.4 The BLM has the responsibility to implement the decisions of the RMP in a manner that protects air quality. BLM also must recognize valid and existing leasing rights. The BLM can require specific actions and measures necessary to protect air quality in response to adverse impacts at the project permitting stage (Management Action 1003).
- 2.2.4.1 BLM will consider applying mitigation to emissions sources not otherwise regulated by WDEQ for mineral development projects where an air quality impact analysis determines there are or will likely be future impacts above acceptable levels, including impacts to Class I areas. Mitigation may include reduction in the pace or scale of development.
- 2.2.5 Until such time as both phases of the Class I area characterization are completed, the BLM will require the following in addition to those items listed above:
- 2.2.5.1 The proponent of a project will be required to minimize air pollutant emissions by complying with all applicable state and federal regulations (including application of best available control technology) and may be required to apply mitigation such as best management practices, and other control technologies or strategies identified by the BLM or WDEQ in accordance with delegated regulatory authority.
- 2.2.5.2 The proponent of a mineral development project that has the potential to emit any regulated air pollutant will be required to provide a detailed description of operator committed measures to reduce project related air pollutant emissions including greenhouse gases and fugitive dust. Project proponents for oil and gas development projects should refer to Table J-4 as a reference for potential mitigation technologies and strategies. The list is not intended to preclude the use of other effective air pollution control technologies that may be proposed. Details of the mitigation measure would be submitted by the applicant and enforced as a condition of the BLM-issued authorization.

- 2.2.5.3 The BLM may require the proponent of other projects to comply with 2.2.5.1 and 2.2.5.2 depending on project characteristics, proximity to a federally mandated Class I area, sensitive Class II area, or population centers, location within a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, magnitude of existing development in the area, or issues identified during project scoping.

2.3 Monitoring

- 2.3.1 As part of a comprehensive air management plan for the Planning Area, BLM will work cooperatively with federal and state agencies with responsibility for managing air resources to determine, characterize, and track air resource conditions. (Management Action 1004)
- 2.3.2 The BLM may require project proponents to conduct air monitoring. The requirement for monitoring will be based on the absence of existing monitoring; existing air quality conditions; magnitude of potential air emissions from the project or activity; magnitude of existing emission sources in the area; proximity to a federally mandated Class I area, sensitive Class II area, or population center; location within a non-attainment or maintenance area; meteorological or geographic conditions; project duration; or issues identified during project scoping. The project proponent will be responsible for siting, installing, operating, and maintaining any required air monitoring.
- 2.3.4 The BLM will support and participate in regional monitoring efforts to meet Management Action 1002 which reads as follows:
- “Define a criteria pollutant and air quality related values monitoring strategy and cooperatively establish a monitoring network by creating a method for siting air quality monitors in order to provide additional data for describing background concentrations.”

2.4 Modeling

- 2.4.1 Air dispersion and photochemical grid models are useful tools for predicting project specific impacts to air quality, predicting the potential effectiveness of control measures and strategies, and for predicting trends in regional concentrations of some air pollutants.
- 2.4.2 BLM may require project proponents to conduct air quality modeling based on the absence of sufficient data to ensure compliance with laws regulations or to determine the effectiveness of mitigation options. The requirement for modeling will follow the MOU and will be based on existing air quality conditions; magnitude of potential air emissions from the project or activity; magnitude of existing emission sources in the area; proximity to a federally mandated Class I area, sensitive Class II area, an area expected to exceed a NAAQS or PSD increment or population center; location within a non-attainment or maintenance area; meteorological or geographic conditions; project duration; or issues identified during project scoping (Management Action 1006).

2.4.3 BLM will support and participate in regional modeling efforts through multi-state and/or multi-agency organizations such as Western Governors' Association – Western Regional Air Partnership (WRAP), the Federal Leadership Forum (FLF), and WDEQ's Ozone Technical Forum (OTF). If results from an interagency, regional modeling study are used to evaluate impacts within the Big Horn Basin, BLM will ensure that direct emissions from BLM's management actions within the region are included in the study. This model would predict direct Big Horn Basin emissions impacts to nearby Class I areas and would satisfy the Air Resources Management Plan Class I Characterization part II as set forth in Section 2.1.1.1, above.

2.5 Mitigation

- 2.5.1 Many of the activities that BLM authorizes, permits, or allows generate air pollutant emissions that have the potential to adversely impact air quality. The primary mechanism to reduce air quality impacts is to reduce emissions (mitigation).
- 2.5.2 BLM will require additional air emission control measures and strategies within its regulatory authority and in consultation with federal and state agencies with responsibility for managing air resources if proposed or committed measures are insufficient to achieve air quality goals (Goal PR: 1 and Goal PR: 2) and objectives (PR:1.1, PR:1.2, PR:2.1, PR2.2) and Management Action 1003.
- 2.5.3 The proponent of a project will be required to minimize air pollutant emissions by complying with all applicable state and federal regulations (including application of best available control technology) and may be required to apply mitigation including but not limited to best management practices, and other control technologies or strategies identified by the BLM or WDEQ in accordance with delegated regulatory authority (Management Action 1003).
- 2.5.4 The proponent of a project will demonstrate regard for air resources and will demonstrate consideration of measures to reduce emissions to achieve Management Action 1003. A project proponent will be required to identify operator-committed measures in its proposal. Example, mitigation strategies for oil and gas development activities are presented in Table J-4.
- 2.5.5 Development and implementation of appropriate protection measures is most effective at the project approval stage, because the proposed action has been defined in terms of temporal and spatial characteristics as well as development processes and procedures. This better defined information allows more precise identification of impacts to air quality which results in more specific impact analysis, and identification of effective mitigation. As part of the project approval process, the BLM will identify project-specific measures in response to identified impacts to air resources.

2.6 Contingency Plans

- 2.6.1 The BLM may require project proponents to submit a contingency plan that provides a strategy for reduction in emissions should observed effects or modeled impacts show state or federal standards or applicable thresholds for air quality related values may be exceeded. Specific operations and pollutants to be addressed in the contingency plan will be determined by BLM on a case-by-case basis taking into account existing air quality and pollutants emitted by the project. This is to ensure conformance with air quality goals and objectives.
- 2.6.2 If observed effects or modeled impacts show state or federal regulatory standards or applicable thresholds for air quality related values may be exceeded, BLM may require mitigation measures to comply with such standards. Mitigation may include management of the pace, place, density and intensity of development or require smaller emission projects to demonstrate compliance with standards or applicable thresholds through quantitative air quality analysis. This is to ensure conformance with the air quality goals and objectives in Table 2-9.

Table J-4. Sample Emission Reduction Strategies for Oil and Gas Development

Emission Reduction Measure	Potential Environmental Benefits	Potential Environmental Liabilities	Feasibility
<i>Control Strategies for Drilling and Compression</i>			
Directional Drilling.	Reduces construction related emissions (dust and vehicle and construction equipment emissions). Decreases surface disturbance and vegetation impacts (dust and CO ₂ and nitrogen flux). Reduces habitat fragmentation.	Could result in higher air impacts in one area with longer sustained drilling times.	Depends on geological strata.
Improved engine technology (Tier 2 or better) for diesel drill rig engines.	Reduced NO _x , PM, CO, and VOC emissions.		Dependent on availability of technology from engine manufacturers.
Selective Catalytic Reduction (SCR) for drill rig engines and/or compressors.	NO _x emissions reduction, potential decreased formation of visibility impairing compounds and ozone. NO _x control efficiency of 95% achieved on drill rig engines. NO _x emission rate of 0.1 g/hp-hr achieved for compressors.	Potential NH ₃ emissions and formation of visibility impairing ammonium sulfate. Regeneration/disposal of catalyst can produce hazardous waste.	Not applicable to 2-stroke engines.

Table J-4. Sample Emission Reduction Strategies for Oil and Gas Development (Continued)

Emission Reduction Measure	Potential Environmental Benefits	Potential Environmental Liabilities	Feasibility
Non-selective catalytic reduction (NSCR) for drill rig engines and/or compressors.	NO _x emissions reduction, potential decreased formation of visibility impairing compounds, and ozone. NO _x control efficiency of 80-90% achieved for drill rig engines. NO _x emission rate of 0.7 g/hp-hr achieved for compressor engines greater than 100 hp.	Regeneration/disposal of catalysts can produce hazardous waste.	Not applicable to lean burn or 2-stroke engines.
Natural Gas fired drill rig engines.	NO _x emissions reduction, potential decreased formation of visibility impairing compounds, and ozone.		Requires onsite processing of field gas.
Electrification of compressors.	Decreased emissions at the source. Transfers emissions to more efficiently controlled source (EGU).	Displaces emissions to electric generating unit (EGU).	Depends on availability of power and transmission lines.
Improved engine technology (Tier 2 or better) for all mobile and non-road diesel engines.	Reduced NO _x , PM, CO, and VOC emissions.		Dependent on availability of technology from engine manufacturers.
Green (a.k.a. closed loop or flareless) completions.	Reduction in VOC and CH4 emissions. Reduces or eliminate flaring and venting and associated emissions. Reduces or eliminates open pits and associated evaporative emissions. Increased recovery of gas to pipeline rather than atmosphere.	Temporary increase in truck traffic and associated emissions.	Need adequate pressure and flow. Need onsite infrastructure (tanks/dehydrator). Availability of sales line. Green completion permits required by WY BACT in some areas.
Green workovers	Same as above.	Same as above.	Same as above.
Minimize/eliminate venting and/or use closed loop process where possible during "blow downs".	Same as above.		Best Management Practices required by WY BACT.
Reclaim/remediate existing open pits, no new open pits.	Reduces VOC and GHG emissions. Reduces potential for soil and water contamination. Reduces odors.	May increase truck traffic and associated emissions.	Requires tank and/or pipeline infrastructure.
Electrification of wellhead compression/pumping.	Reduces local emissions of fossil fuel combustion and transfers to more easily controlled source.	Displaces emissions to electric generating unit (EGU).	Depends on availability of power and transmission lines.
Wind (or other renewable) generated power for compressors.	Low or no emissions.	May require construction of infrastructure. Visual impacts. Potential wildlife impacts.	Depends on availability of power and transmission lines.

Table J-4. Sample Emission Reduction Strategies for Oil and Gas Development (Continued)

Emission Reduction Measure	Potential Environmental Benefits	Potential Environmental Liabilities	Feasibility
<i>Control Strategies Utilizing Centralized Systems</i>			
Centralization (or consolidation) of gas processing facilities (separation, dehydration, sweetening, etc.).	Reduces vehicle miles traveled (truck traffic) and associated emissions. Reduced VOC and GHG emissions from individual dehy/separator units.	Temporary increase in construction associated emissions. Higher potential for pipe leaks/groundwater impacts.	Requires pipeline infrastructure.
Liquids Gathering systems (for condensate and produced water).	Reduces vehicle miles traveled and associated emissions. Reduced VOC and GHG emissions from tanks, truck loading/unloading, and multiple production facilities.	Temporary increase in construction associated emissions. Higher potential for pipe leaks/groundwater impacts.	Requires pipeline infrastructure.
Water and/or fracturing liquids delivery system.	Reduced long term truck traffic and associated emissions.	Temporary increase in construction associated emissions. Higher potential for pipe leaks/groundwater impacts.	Requires pipeline infrastructure. Not feasible for some terrain.
<i>Control Strategies for Tanks, Separators, and Dehydrators</i>			
Eliminate use of open top tanks.	Reduced VOC and GHG emissions.		Required by WY BACT for produced water tanks in some areas.
Capture and control of flashing emissions from all storage tanks and separation vessels with vapor recovery and/or thermal combustion units.	Reduces VOC and GHG emissions.	Pressure build up on older tanks can lead to uncontrolled rupture.	98% VOC control if \geq 10 TPY required statewide by WY BACT.
Capture and control of produced water tank emissions.	Reduces VOC and GHG emissions.		98% VOC control and no open top tanks required by WY DEQ in some areas.
Capture and control of dehydration equipment emissions with condensors, vapor recovery, and/or thermal combustion.	Reduces VOC, HAP, and GHG emissions.		Still vent condensors required and 98% VOC control if \geq 8 TPY required statewide and in CDA by WY BACT. All dehy emissions controlled at 98% in JPAD (no 8 TPY threshold).
<i>Control Strategies for Misc. Fugitive VOC Emissions</i>			
Install and maintain low VOC emitting seals, valves, hatches on production equipment.	Reduces VOC and GHG emissions.		
Initiate an equipment leak detection and repair program (including use of FLIR cameras, grab samples, organic vapor detection devices, visual inspection, etc.).	Reduction in VOC and GHG emissions.		

Table J-4. Sample Emission Reduction Strategies for Oil and Gas Development (Continued)

Emission Reduction Measure	Potential Environmental Benefits	Potential Environmental Liabilities	Feasibility
Install or convert gas operated pneumatic devices to electric, solar, or instrument (or compressed) air driven devices/controllers.	Reduces VOC and GHG emissions.	Electric or compressed air driven operations can displace or increase combustion emissions.	
Use "low" or "no bleed" gas operated pneumatic devices/controllers.	Reduces VOC and GHG emissions.		or closed loop required statewide by WY BACT.
Use closed loop system or thermal combustion for gas operated pneumatic pump emissions.	Reduces VOC and GHG emissions.		Required statewide by WY BACT (98% VOC control or closed loop).
Install or convert gas operated pneumatic pumps to electric, solar, or instrument (or compressed) air driven pumps.	Reduces VOC and GHG emissions.	Electric or compressed air driven operations can displace or increase combustion emissions.	Required statewide by WY BACT if no thermal combustion used.
Install vapor recovery on truck loading/unloading operations at tanks.	Reduces emissions of VOC and GHG emissions.	Pressure build up on older tanks can lead to uncontrolled rupture.	WY BACT analysis required if $VOC \geq 8 \text{ TPY}$ or $HAP \geq 5 \text{ TPY}$.
<i>Control Strategies for Fugitive Dust and Vehicle Emissions</i>			
Unpaved surface treatments including watering, chemical suppressants, and gravel.	20% - 80% control of fugitive dust (particulates) from vehicle traffic.	Potential impacts to water and vegetation from runoff of suppressants.	
Use remote telemetry and automation of wellhead equipment.	Reduces vehicle traffic and associated emissions.		
Speed limit control and enforcement on unpaved roads.	Reduction of fugitive dust emissions.		
Reduce commuter vehicle trips through car pools, commuter vans or buses, innovative work schedules, or work camps.	Reduced combustion emissions, reduced fugitive dust emissions, reduced ozone formation, reduced impacts to visibility.		
<i>Miscellaneous Control Strategies</i>			
Use of ultra-low sulfur diesel in engines, compressors, construction equipment, etc.	Reduces emissions of particulates and sulfates.		Fuel not readily available in some areas.
Reduce unnecessary vehicle idling.	Reduced combustion emissions, reduced ozone formation, reduced impacts to visibility, reduced fuel consumption.		
Reduced pace of (phased) development.	Peak emissions of all pollutants reduced.	Emissions generated at a lower rate but for a longer period. LOP, duration of impacts is longer.	May not be economically viable or feasible if multiple mineral interests.